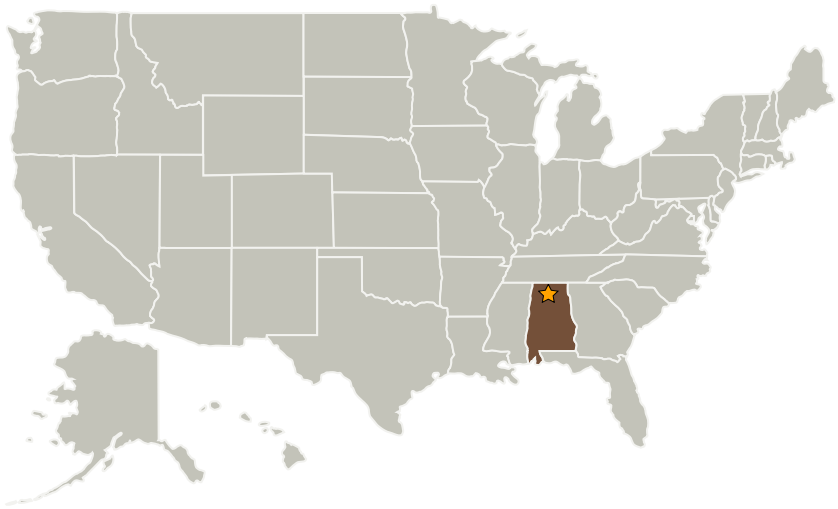
Advanced Nongray Radiation Module in the LOCI Framework for Combustion CFD, Phase I

Completed Technology Project (2006 - 2007)

Project Introduction

In this STTR, an innovative, efficient and high fidelity computational tool to predict radiative heat transfer will be implemented in the LOCI framework. Radiative heat transfer in rocket engine combustion can play a significant role in determining engine performance and combustor wall heat loading. Radiation will also become increasingly important as hydrocarbon-based fuels are used in rocket propulsion as alternatives to hydrogen, for in-situ propellants, and in the development of nontoxic fuels for reaction control thrusters. Currently there is no radiation modeling capability in the LOCI framework, the basis for codes used by NASA and their contractors to design and analyze rocket engines. CFDRC has teamed with Mississippi State University (MSU), the original developer of LOCI, to develop the needed radiation module. In Phase I, the well-established Control-Angle Discrete Ordinates Method will be implemented for solving the Radiative Transfer Equation. This module will be used in the combustion code, CHEM, and tested with proven gray and nongray gas radiation models to establish the framework for future development and to demonstrate the feasibility of radiation modeling using LOCI. In Phase II, efforts will focus on developing increasingly accurate and robust nongray gas models such as the narrow band models, Weight-Sum-of-Gray-Gases method, and the innovative Full Spectrum Correlated k-distribution model.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Marshall Space Flight Center(MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
CFD Research Corporation	Supporting Organization	Industry	Huntsville, Alabama

Primary U.S. Work Locations
Alabama

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Rex Chamberlain

Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  - TX15.1 Aerosciences
    - TX15.1.2 Aerothermodynamics